

# PATENT ABSTRACTS OF JAPAN

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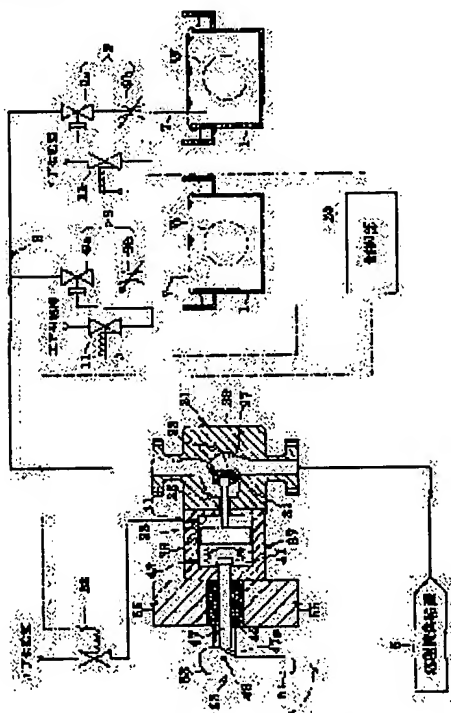
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## (54) FLUID CONTROL DEVICE AND SUBSTRATE TREATMENT DEVICE USING IT



### (57)Abstract:

PROBLEM TO BE SOLVED: To provide a fluid control device and a substrate treatment device using it capable of reducing a fixing space by improving valve structure.

SOLUTION: A treatment fluid flow is controlled by driving a valve element 33 by a holding section 37 of a valve casing 29 and the flow of the treatment fluid is prohibited by a press member 47 arranged on the valve casing 29 despite the operation of the holding section 37. Thereby two functions of a conventional toggle valve and a relief valve can be integrated. Accordingly, the fluid control device capable of reducing the fixing space can be obtained.

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**DETAILED DESCRIPTION**

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[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention relates to the substrate processor using the fluid control unit and this which control the flow of fluids, such as liquids, such as processing liquid containing a medical fluid, and a gas, which processes by supplying processing liquid to substrates (a substrate only being called hereafter), such as a semiconductor wafer and a glass substrate for liquid crystal displays.

[0002]

[Description of the Prior Art] Conventionally, a thing as shown in the block diagram of drawing 6 is mentioned as this kind of a substrate processor.

[0003] Processing liquid is supplied to the processing tub 1 in which Substrate W is held for processing with processing liquid through a process line 3. To the end side of a process line 3, the processing liquid source of supply 5 is open for free passage, and free passage connection of two or more branch pipes 7 is made at the other end side. The flow control valve 9 which adjusts the flow rate of processing liquid is attached in two or more branch pipes 7, and these operate according to supply of the air by the solenoid valve 11, respectively. Moreover, in order to stop circulation of processing liquid in the time of a maintenance etc., the toggle bulb 13 operated manually is attached in the process line 3. Furthermore, when the control section which is not illustrated detects the abnormalities of processing, in order to stop circulation of processing liquid, the relief valve 17 which operates according to supply of the air by the solenoid valve 15 is attached.

[0004]

[Problem(s) to be Solved by the Invention] However, in the case of the conventional example which has such composition, there are the following problems. That is, since conventional equipment needs to prepare two valves, the toggle bulb 13 and a relief valve 17, in a process line 3, it has the problem that these installation spaces become comparatively large.

[0005] This invention is made in view of such a situation, and aims at offering the fluid control unit which can make an installation space small, and the substrate processor using this by devising the structure of a valve or devising control of a relief valve.

[0006]

[Means for Solving the Problem] This invention takes the following composition, in order to attain such a purpose. That is, invention according to claim 1 is characterized by to equip the aforementioned valve box with the means for switching to which the state make the aforementioned valve element contact to a valve seat, or the aforementioned valve element switches the state where of it can estrange to a valve seat while it equips a

valve box with the valve element which sets to the fluid control unit which controls the flow of a fluid, contacts or estranges to a valve seat, and controls the flow of a fluid, and the driving means which drive the aforementioned valve element.

[0007] It is characterized by equipping the aforementioned driving means with the attaching part which holds the valve rod connected with the aforementioned valve element possible [ an attitude ] to a valve seat side in a fluid control unit according to claim 1, and invention according to claim 2 performing introduction or discharge of a drive fluid to the aforementioned attaching part.

[0008] Invention according to claim 3 is characterized by equipping the aforementioned means for switching with the press member which can move to the opposite side in which the valve element was attached among the aforementioned valve rods, and the attitude driving means which carry out the attitude drive of the aforementioned press member to the aforementioned valve rod in a fluid control unit according to claim 1 or 2.

[0009] Invention according to claim 4 is characterized by for the aforementioned attitude driving means having equipped the end side with the piece of maintenance on both sides of the eccentric shaft, and equipping them with the piece of contact which contacts the aforementioned press member at an other end side in a fluid control unit according to claim 3.

[0010] Invention according to claim 5 is characterized by attaching the aforementioned press member, where the valve rod connected with the aforementioned valve element is projected toward the attaching part shell exterior held possible [ an attitude ] to a valve seat side in a fluid control unit according to claim 3 or 4.

[0011] In the substrate processor which invention according to claim 6 adjusts the flow rate of the processing liquid supplied from a processing liquid supply means with a flow regulation means, and supplies processing liquid to a substrate While equipping a valve box with the valve element which contacts or estranges to a valve seat and controls the flow of processing liquid directly, and the driving means which drive the aforementioned valve element The state of making the aforementioned valve element contacting to a valve seat, or the aforementioned valve element is characterized by having the fluid control unit which equipped the aforementioned valve box with the means for switching which switch the state where it can estrange to a valve seat between the aforementioned processing liquid supply means and the aforementioned flow regulation means.

[0012] In the fluid control unit with which invention according to claim 7 controls the flow of a fluid The control valve which controls the flow of flowing fluid for a process line by the drive fluid, and subpiping which supplies a drive fluid to the aforementioned control valve, It is arranged by the aforementioned subpiping and characterized by things with the means for switching which switch the driving means which control a drive fluid and carry out the opening-and-closing drive of the aforementioned control valve, the state of permitting the opening-and-closing drive by the aforementioned driving means, and the state of forbidding the switching action by the aforementioned driving means.

[0013] Invention according to claim 8 is characterized by the aforementioned control valve being a no MARIKU rose formula in a fluid control unit according to claim 7.

[0014] Invention according to claim 9 is characterized by the aforementioned means for switching being the manual opening-and-closing valves arranged by the aforementioned subpiping in a fluid control unit according to claim 7 or 8.

[0015] In the substrate processor which invention according to claim 10 adjusts the flow

rate of the processing liquid supplied through a process line from a processing liquid supply means with a flow regulation means, and supplies processing liquid to a substrate. The control valve which controls the flow of the processing liquid which flows a process line by the drive fluid, and subpiping which supplies a drive fluid to the aforementioned control valve, The driving means which are arranged by the aforementioned subpiping, control the flow of a drive fluid, and carry out the opening-and-closing drive of the aforementioned control valve, It is characterized by having the means for switching which switch the state of permitting the opening-and-closing drive by the aforementioned driving means, and the state of forbidding the switching action by the aforementioned driving means, and the fluid control unit which it had between the aforementioned processing liquid supply means and the aforementioned flow regulation means.

[0016]

[Function] The operation of invention according to claim 1 is as follows. That is, while the flow of a fluid is controllable by the driving means of a valve box driving a valve element, circulation of a fluid can be forbidden irrespective of operation of driving means by the means for switching arranged by the valve box.

[0017] According to invention according to claim 2, a valve rod is made to advance to a valve seat side by introducing a drive fluid into an attaching part, a valve seat is stopped with a valve element, and circulation of a fluid is forbidden. Moreover, a valve rod is made to shunt a valve seat side by discharging a drive fluid from an attaching part, a valve seat is opened wide, and circulation of a fluid is permitted.

[0018] In addition, air, inert gas, oil, etc. are mentioned as a drive fluid.

[0019] According to invention according to claim 3, if a press member is driven by attitude driving means, a press member will make a valve rod march out, and a valve element will prevent circulation of a fluid in contact with a valve seat.

[0020] According to invention according to claim 4, if the piece of maintenance is moved, the piece of contact which is in an opposite side on both sides of an eccentric shaft will contact a press member, and, thereby, a press member will move to a valve rod.

[0021] according to invention according to claim 5 -- a press member -- the attaching part shell exterior -- turning -- projection -- it is installation \*\*\*\*\* in the state the bottom, and it can be made to be able to expose to the case shell exterior of equipment, and means for switching can be attached, in case a fluid control unit is attached

[0022] According to invention according to claim 6, the installation number of a valve can be reduced by attaching the control-of-flow equipment equipped with the function which controls the flow of a fluid directly, and the function in which circulation of a fluid can be compulsorily forbidden manually by means for switching, in one between a processing liquid supply means and a flow regulation means.

[0023] While according to invention according to claim 7 a control valve can be controlled by driving means and the fluid of a process line can be controlled by them by this, circulation of the fluid in a process line can be forbidden by forbidding operation of driving means by means for switching.

[0024] A process line can be stopped, if it is the control valve of the no MARIKU rose formula which is usually sometimes stopped according to invention according to claim 8 and operation of driving means will be forbidden by means for switching.

[0025] According to invention according to claim 9, since the drive fluid of subpiping is controllable by the opening-and-closing valve, this can be used as means for switching.

[0026] According to invention according to claim 10, the installation number of the valve to a process line can be reduced by attaching control-of-flow equipment equipped with the function which controls the flow of the fluid of a process line directly, and the function in which circulation of a fluid can be forbidden by means for switching, between a processing liquid supply means and a flow regulation means.

[0027] In addition, air, inert gas, oil, etc. are mentioned as a drive fluid.

[0028]

[Embodiments of the Invention] Hereafter, one example of this invention is explained with reference to a drawing.

<1st example> drawing 1 or drawing 3 starts one example of this invention, drawing 1 is the block diagram showing the outline composition of the substrate processor using the fluid control unit concerning this example, drawing 2 is drawing showing the circulation state of processing liquid, and drawing 3 is drawing showing the state where operated the shift lever and processing liquid was intercepted. In addition, the same sign is attached about the same composition as the conventional example mentioned above.

[0029] Processing liquid is stored by the processing tub 1, Substrate W is held into this, and processing is performed. To this processing tub 1, processing liquid is supplied through a process line 3. Free passage connection of the processing liquid source of supply 5 is made at the end side of a process line 3, and free passage connection of two or more branch pipes 7 is made at the other end side (only two are illustrated all over drawing). The flow control valve 9 which adjusts the flow rate of processing liquid is attached in each of two or more branch pipes 7. The flow control valve 9 is equipped with opening-and-closing valve 9a and throttle valve 9b, and throttle valve 9b is adjusted so that it may become a flow rate required for processing beforehand. A flow control valve 9 operates by the solenoid valve 11 which controls supply of the air from an air source of supply according to the control signal shown by the dotted-line arrow all over drawing.

[0030] In addition, the above-mentioned processing liquid source of supply 5 is equivalent to the processing liquid supply means in this invention, and the above-mentioned flow control valve 9 is equivalent to a flow regulation means.

[0031] The main-movement valve 21 which is the feature of this example is attached in the process line 3. This main-movement valve 21 has the function which controls circulation of the processing liquid in a process line 3, and operates by the solenoid valve 23 which controls supply of the air (drive fluid) from an air source of supply according to a control signal. The control signal to a solenoid valve 11 and a solenoid valve 23 is given by the control section 25 which carries out generalization control of this substrate processor.

[0032] The main-movement valve 21 is equipped with the valve box 29 with which the passage 27 which has the entrance and outlet of processing liquid was formed. The valve seat 31 is formed near the center section of passage 27. This valve seat 31 is formed so that it may be mostly in agreement with the appearance of the valve element 33 which controls directly the flow of the processing liquid which contacts or estranges into the portion and circulates passage 27. The end of a valve rod 35 is connected with the valve element 33. Moreover, the valve box 29 is equipped with the attaching part 37 which holds a valve rod 35 possible [ the attitude to a valve seat 31 side ]. While the cylinder 38 is formed in this attaching part 37, the other end of a valve rod 35 is equipped with the piston 39 by which interlocking connection was carried out free [ sliding ] here. By the

normal state, the piston 39 is energized by the compression spring 41 so that a valve element 33 may contact to a valve seat 31.

[0033] Moreover, the attaching part 37 equips with the 1st breakthrough 41 and 2nd breakthrough 43 the position whose piston 39 is pinched. While, as for the 1st breakthrough 41, supply of an air source of supply to air is controlled by the solenoid valve 23, the 2nd breakthrough 43 is wide opened by the atmosphere. If a solenoid valve 23 is operated, in a cylinder 38, a piston 39 will be moved to the 2nd breakthrough 43 side by air \*\*, and a valve element 33 will estrange from a valve seat 31 by it (refer to drawing 2 (a)). If operation of one of these and a solenoid valve 23 is stopped, a piston 39 will return in the energization direction and a valve element 33 will contact a valve seat 31 (refer to drawing 2 (b)).

[0034] The installation section 45 is arranged by the opposite side of a valve box 29 among attaching parts 37. the hole which is open for free passage in a cylinder 38 forms in this installation section 45 -- having -- \*\*\*\* -- here -- press -- the member 47 is inserted the press formed in the shape of a pin -- a member 47 is not illustrated -- it pulls, and in the piston 39, it is energized by the coil spring at the opposite side, and the end face section 47a is spherically formed of it

[0035] press -- the lever 48 of operation is arranged at the end face section 47a side of a member 47 This lever 48 of operation equipped the end side with the piece 51 of maintenance on both sides of the eccentric shaft 49, and is equipped with the piece 53 of contact which contacts an other end side at end face section 47a. Moreover, this main-movement valve 21 is attached to the wall material 55 outside the substrate processor in the portion of the installation section 45, and the lever 48 of operation is in the state where it projected to the outside wall material 55 shell exterior.

[0036] it is shown in drawing 3 -- as -- the piece 51 of maintenance of the lever 48 of operation -- a near side -- lengthening ( drawing 3 the direction of the upper left) -- the piece 53 of contact -- the circumference of an eccentric shaft 49 -- rotating -- press -- a member 47 is extruded towards a piston 39 and a valve element 33 contacts a valve seat 31 That is, the lever 48 of operation can switch the state of making a valve element 33 contacting compulsorily to a valve seat 31, and the state where a valve element 33 can estrange to a valve seat 31.

[0037] in addition, the press mentioned above -- a member 47 and the lever 48 of operation are equivalent to the means for switching in this invention, and the lever 48 of operation mentioned above is equivalent to attitude driving means

[0038] thus, the press arranged by the valve box 29 while controlling the flow of the processing liquid of a process line 3 by driving a valve element 33 by the attaching part 37 with which the valve box 29 was equipped -- circulation of a fluid is compulsorily forbidden irrespective of the operating state of an attaching part 37 by the member 47 and the lever 48 of operation Since two functions, the conventional toggle bulb (13) and a relief valve (17), can be made into one by this, the main-movement valve 21 which can make an installation space small is realizable.

[0039] moreover -- if the piece 51 of maintenance of the lever 48 of operation is moved by hand -- press -- a member 47 moves to a valve rod 35, and can prevent circulation of a fluid The circulation state of processing liquid can be known only by this looking at the state of the piece 51 of maintenance. furthermore, the time of attaching -- press -- a member 47 -- the outer wall of a substrate processor -- since it can be made to be able to

expose outside and can attach from a member 55, the circulation state of processing liquid is easily controllable by the lever 48 of operation from the outside of equipment [0040] thus, the function which controls the flow of processing liquid directly and press - the installation number of a valve can be reduced by attaching the main-movement valve 21 equipped with the function in which circulation of processing liquid can be compulsorily forbidden manually by the member 47, in one between the processing liquid source of supply 5 and a flow control valve 9 Therefore, the installation space of the main-movement valve 21 in a substrate processor can be made small.

[0041] In addition, this invention is not limited to the above-mentioned operation gestalt, and deformation implementation is possible for it as follows.

[0042] (1) Driving means may be replaced with the valve element 33 which moves with air as mentioned above, and the valve element 33 which moves by electromagnetic may be used for them.

[0043] (2) the shift lever 48 equipped with the eccentric shaft 49 which attitude driving means mentioned above -- replacing with -- press -- you may adopt structure like a push button which is pushed in towards the attitude direction of a member 47

[0044] (3) It is not necessary to necessarily attach a fluid control unit in the wall material 55 outside a substrate processor, it is attached in the interior of a substrate processor, and you may make it use it.

[0045] <2nd example> drawing 4 starts one example of this invention, and drawing 4 is the block diagram showing the outline composition of the substrate processor using the fluid control unit concerning this example. In addition, about detailed explanation, it omits by attaching a same sign about the same composition as the 1st example mentioned above.

[0046] The relief valve 17 (equivalent to the control valve of this invention) of the air drive formula for controlling the flow of processing liquid directly is arranged in the process line 3. This relief valve 17 serves as a no MARIKU rose formula, and the air as a drive fluid is supplied through the subpiping 61. Usually, although the air which circulates the subpiping 61 is controlled by the solenoid valve 23 (it is equivalent to the driving means of this invention), with this example equipment, the opening-and-closing valve 63 (equivalent to the means for switching of this invention) of a manual operation formula is further attached in the subpiping 61. In addition, a relief valve 17, the opening-and-closing valve 63, and the subpiping 61 constitute the main-movement valve 65, and this is equivalent to a fluid control unit.

[0047] The opening-and-closing valve 63 of the main-movement valve 65 switches the state of permitting the opening-and-closing drive of the relief valve 17 by the solenoid valve 23, and the state of forbidding the switching action of the relief valve 17 by the solenoid valve 23. Moreover, since the relief valve 17 of the main-movement valve 65 is a no MARIKU rose formula usually stopped sometimes, if operation of a solenoid valve 23 is forbidden with the opening-and-closing valve 63, a process line 3 can be stopped and control can be simplified. Moreover, although the opening-and-closing valve 63 (equivalent to the conventional toggle bulb 13) which needed to be attached in the process line 3 will be conventionally formed in the subpiping 61, since the path is very small as compared with a process line 3, installation of management of piping, a valve, etc. is also easy for the subpiping 61.

[0048] Thus, according to this example, the relief valve 17 of the main-movement valve



65 can be controlled by the solenoid valve 23 arranged by the subpiping 61, and circulation of the processing liquid in a process line 3 can be forbidden by forbidding operation of a solenoid valve 23 by the opening-and-closing valve 63 of the main-movement valve 65. Therefore, the number of the valve attached in a process line 3 can be reduced, and the fluid control unit which can make an installation space small can be realized. Moreover, composition can be simplified by using the opening-and-closing valve 63 as means for switching.

[0049] Moreover, the installation number of the valve to a process line 3 can be reduced by attaching control-of-flow equipment equipped with the function which controls the flow of the processing liquid of a process line 3 directly, and the function in which circulation of processing liquid can be compulsorily forbidden by the opening-and-closing valve 63, between the processing liquid source of supply 5 and a flow control valve 9. Therefore, the installation space of the fluid control unit in a substrate processor can be made small.

[0050] In addition, this 2nd example can carry out deformation implementation, as shown in the block diagram of drawing 5.

[0051] That is, the main-movement valve 67 is equipped with the relief valve 17 arranged by the process line 3 and the pushbutton switch 69 which closes / opens the control signal line given to a solenoid valve 23 from a control section 25. In this composition, the state where the control signal line is closed by the pushbutton switch 69 equivalent to means for switching, and the state where the control signal line is opened are equivalent to the state of permitting the opening-and-closing drive of the relief valve 17 by the solenoid valve 23, and the state of forbidding the switching action of the relief valve 17 by the solenoid valve 23, and a pushbutton switch 69 is equivalent to the means for switching in this invention.

[0052] Even if it is such composition, the same effect as the 2nd example mentioned above can be acquired. Since a pushbutton switch 69 is moreover only added, there is also an advantage that only an electric wiring change etc. is required.

[0053] In addition, the drive fluid in this invention is not limited to the air (air) mentioned above, and gases, such as inert gas (for example, nitrogen gas), and liquids, such as oil, may be used.

[0054] Moreover, the fluid control unit of this invention can be used also in other industries which deal with not only the substrate processor related technology in a semiconductor etc. but a fluid as explained in each example. Furthermore, it can use not only for liquids, such as processing liquid, but for controlling a gaseous flow.

[0055] Furthermore, the substrate processor of this invention is applicable even if it is the equipment which forms an application coat not only in the equipment which performs washing processing with the processing liquid mentioned above but in a substrate, equipment which performs plating processing.

[0056]

[Effect of the Invention] According to invention according to claim 1, the flow of a fluid is controlled by driving a valve element by the driving means of a valve box, and circulation of a fluid is forbidden irrespective of operation of driving means by the means for switching arranged by the valve box so that clearly from the above explanation.

Thereby, two functions, the conventional toggle bulb and a relief valve, can be made into one. Therefore, the fluid control unit which can make an installation space small is

realizable.

[0057] According to invention according to claim 2, a valve rod can be made to be able to advance to a valve seat side by introducing a drive fluid into an attaching part, or a valve rod is made to shunt a valve seat side by discharging a drive fluid from an attaching part, and circulation of a fluid can be controlled. Therefore, a fluid is controllable by comparatively easy operation called introduction and ejection of a fluid.

[0058] According to invention according to claim 3, circulation of a fluid can be prevented only by driving a press member by attitude driving means.

[0059] According to invention according to claim 4, if the piece of maintenance is moved by hand, a press member moves to a valve rod and can prevent circulation of a fluid. Circulation of a fluid can be known only by this looking at the state of the piece of maintenance.

[0060] Since according to invention according to claim 5 it can be made to be able to expose outside and a press member can be attached from the case of equipment in case a fluid control unit is attached, circulation of a fluid is easily controllable from the outside of equipment.

[0061] According to invention according to claim 6, the installation number of a valve can be reduced by attaching the control-of-flow equipment equipped with the function which controls the flow of a fluid directly, and the function in which circulation of a fluid can be compulsorily forbidden manually by means for switching, in one between a processing liquid supply means and a flow regulation means. Therefore, the installation space of the fluid control unit in a substrate processor can be made small.

[0062] According to invention according to claim 7, a control valve can be controlled by driving means and circulation of the fluid in a process line can be forbidden by forbidding operation of driving means by means for switching. Therefore, the number of the valve attached in a process line can be reduced, and the fluid control unit which can make an installation space small can be realized.

[0063] If it is the control valve of the no MARIKU rose formula which is usually sometimes stopped according to invention according to claim 8 and operation of driving means will be forbidden by means for switching, a process line can be stopped and control can be simplified.

[0064] According to invention according to claim 9, composition can be simplified by using an opening-and-closing valve as means for switching.

[0065] According to invention according to claim 10, the installation number of the valve to a process line can be reduced by attaching control-of-flow equipment equipped with the function which controls the flow of the fluid of a process line directly, and the function in which circulation of a fluid can be compulsorily forbidden by means for switching, between a processing liquid supply means and a flow regulation means. Therefore, the installation space of the fluid control unit in a substrate processor can be made small.

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## TECHNICAL FIELD

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[The technical field to which invention belongs] This invention relates to the substrate processor using the fluid control unit and this which control the flow of fluids, such as liquids, such as processing liquid containing a medical fluid, and a gas, which processes by supplying processing liquid to substrates (a substrate only being called hereafter), such as a semiconductor wafer and a glass substrate for liquid crystal displays.

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## PRIOR ART

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[Description of the Prior Art] Conventionally, a thing as shown in the block diagram of drawing 6 is mentioned as this kind of a substrate processor.

[0003] Processing liquid is supplied to the processing tub 1 in which Substrate W is held for processing with processing liquid through a process line 3. To the end side of a process line 3, the processing liquid source of supply 5 is open for free passage, and free passage connection of two or more branch pipes 7 is made at the other end side. The flow control valve 9 which adjusts the flow rate of processing liquid is attached in two or more branch pipes 7, and these operate according to supply of the air by the solenoid valve 11, respectively. Moreover, in order to stop circulation of processing liquid in the time of a maintenance etc., the toggle bulb 13 operated manually is attached in the process line 3. Furthermore, when the control section which is not illustrated detects the abnormalities of processing, in order to stop circulation of processing liquid, the relief valve 17 which operates according to supply of the air by the solenoid valve 15 is attached.

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## EFFECT OF THE INVENTION

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[Effect of the Invention] According to invention according to claim 1, the flow of a fluid is controlled by driving a valve element by the driving means of a valve box, and circulation of a fluid is forbidden irrespective of operation of driving means by the means for switching arranged by the valve box so that clearly from the above explanation. Thereby, two functions, the conventional toggle bulb and a relief valve, can be made into one. Therefore, the fluid control unit which can make an installation space small is realizable.

[0057] According to invention according to claim 2, a valve rod can be made to be able to advance to a valve seat side by introducing a drive fluid into an attaching part, or a valve rod is made to shunt a valve seat side by discharging a drive fluid from an attaching part, and circulation of a fluid can be controlled. Therefore, a fluid is controllable by comparatively easy operation called introduction and discharge of a fluid.

[0058] According to invention according to claim 3, circulation of a fluid can be prevented only by driving a press member by attitude driving means.

[0059] According to invention according to claim 4, if the piece of maintenance is moved

by hand, a press member moves to a valve rod and can prevent circulation of a fluid. Circulation of a fluid can be known only by this looking at the state of the piece of maintenance.

[0060] Since according to invention according to claim 5 it can be made to be able to expose outside and a press member can be attached from the case of equipment in case a fluid control unit is attached, circulation of a fluid is easily controllable from the outside of equipment.

[0061] According to invention according to claim 6, the installation number of a valve can be reduced by attaching the control-of-flow equipment equipped with the function which controls the flow of a fluid directly, and the function in which circulation of a fluid can be compulsorily forbidden manually by means for switching, in one between a processing liquid supply means and a flow regulation means. Therefore, the installation space of the fluid control unit in a substrate processor can be made small.

[0062] According to invention according to claim 7, a control valve can be controlled by driving means and circulation of the fluid in a process line can be forbidden by forbidding operation of driving means by means for switching. Therefore, the number of the valve attached in a process line can be reduced, and the fluid control unit which can make an installation space small can be realized.

[0063] If it is the control valve of the no MARIKU rose formula which is usually sometimes stopped according to invention according to claim 8 and operation of driving means will be forbidden by means for switching, a process line can be stopped and control can be simplified.

[0064] According to invention according to claim 9, composition can be simplified by using an opening-and-closing valve as means for switching.

[0065] According to invention according to claim 10, the installation number of the valve to a process line can be reduced by attaching control-of-flow equipment equipped with the function which controls the flow of the fluid of a process line directly, and the function in which circulation of a fluid can be compulsorily forbidden by means for switching, between a processing liquid supply means and a flow regulation means. Therefore, the installation space of the fluid control unit in a substrate processor can be made small.

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## TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] However, in the case of the conventional example which has such composition, there are the following problems. That is, since conventional equipment needs to prepare two valves, the toggle bulb 13 and a relief valve 17, in a process line 3, it has the problem that these installation spaces become comparatively large.

[0005] This invention is made in view of such a situation, and aims at offering the fluid control unit which can make an installation space small, and the substrate processor using this by devising the structure of a valve or devising control of a relief valve.

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## MEANS

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[Means for Solving the Problem] This invention takes the following composition, in order to attain such a purpose. That is, invention according to claim 1 is characterized by to equip the aforementioned valve box with the means for switching to which the state make the aforementioned valve element contact to a valve seat, or the aforementioned valve element switches the state where of it can estrange to a valve seat while it equips a valve box with the valve element which sets to the fluid control unit which controls the flow of a fluid, contacts or estranges to a valve seat, and controls the flow of a fluid, and the driving means which drive the aforementioned valve element.

[0007] It is characterized by equipping the aforementioned driving means with the attaching part which holds the valve rod connected with the aforementioned valve element possible [ an attitude ] to a valve seat side in a fluid control unit according to claim 1, and invention according to claim 2 performing introduction or discharge of a drive fluid to the aforementioned attaching part.

[0008] Invention according to claim 3 is characterized by equipping the aforementioned means for switching with the press member which can move to the opposite side in which the valve element was attached among the aforementioned valve rods, and the attitude driving means which carry out the attitude drive of the aforementioned press member to the aforementioned valve rod in a fluid control unit according to claim 1 or 2.

[0009] Invention according to claim 4 is characterized by for the aforementioned attitude driving means having equipped the end side with the piece of maintenance on both sides of the eccentric shaft, and equipping them with the piece of contact which contacts the aforementioned press member at an other end side in a fluid control unit according to claim 3.

[0010] Invention according to claim 5 is characterized by attaching the aforementioned press member, where the valve rod connected with the aforementioned valve element is projected toward the attaching part shell exterior held possible [ an attitude ] to a valve seat side in a fluid control unit according to claim 3 or 4.

[0011] In the substrate processor which invention according to claim 6 adjusts the flow rate of the processing liquid supplied from a processing liquid supply means with a flow regulation means, and supplies processing liquid to a substrate While equipping a valve box with the valve element which contacts or estranges to a valve seat and controls the flow of processing liquid directly, and the driving means which drive the aforementioned valve element The state of making the aforementioned valve element contacting to a valve seat, or the aforementioned valve element is characterized by having the fluid control unit which equipped the aforementioned valve box with the means for switching which switch the state where it can estrange to a valve seat between the aforementioned processing liquid supply means and the aforementioned flow regulation means.

[0012] In the fluid control unit with which invention according to claim 7 controls the flow of a fluid The control valve which controls the flow of flowing fluid for a process line by the drive fluid, and subpiping which supplies a drive fluid to the aforementioned control valve, It is arranged by the aforementioned subpiping and characterized by things with the means for switching which switch the driving means which control a drive fluid and carry out the opening-and-closing drive of the aforementioned control valve, the state

of permitting the opening-and-closing drive by the aforementioned driving means, and the state of forbidding the switching action by the aforementioned driving means.

[0013] Invention according to claim 8 is characterized by the aforementioned control valve being a no MARIKU rose formula in a fluid control unit according to claim 7.

[0014] Invention according to claim 9 is characterized by the aforementioned means for switching being the manual opening-and-closing valves arranged by the aforementioned subpiping in a fluid control unit according to claim 7 or 8.

[0015] In the substrate processor which invention according to claim 10 adjusts the flow rate of the processing liquid supplied through a process line from a processing liquid supply means with a flow regulation means, and supplies processing liquid to a substrate. The control valve which controls the flow of the processing liquid which flows a process line by the drive fluid, and subpiping which supplies a drive fluid to the aforementioned control valve, The driving means which are arranged by the aforementioned subpiping, control the flow of a drive fluid, and carry out the opening-and-closing drive of the aforementioned control valve, It is characterized by having the means for switching which switch the state of permitting the opening-and-closing drive by the aforementioned driving means, and the state of forbidding the switching action by the aforementioned driving means, and the fluid control unit which it had between the aforementioned processing liquid supply means and the aforementioned flow regulation means.

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## OPERATION

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[Function] The operation of invention according to claim 1 is as follows. That is, while the flow of a fluid is controllable by the driving means of a valve box driving a valve element, circulation of a fluid can be forbidden irrespective of operation of driving means by the means for switching arranged by the valve box.

[0017] According to invention according to claim 2, a valve rod is made to advance to a valve seat side by introducing a drive fluid into an attaching part, a valve seat is stopped with a valve element, and circulation of a fluid is forbidden. Moreover, a valve rod is made to shunt a valve seat side by discharging a drive fluid from an attaching part, a valve seat is opened wide, and circulation of a fluid is permitted.

[0018] In addition, air, inert gas, oil, etc. are mentioned as a drive fluid.

[0019] According to invention according to claim 3, if a press member is driven by attitude driving means, a press member will make a valve rod march out, and a valve element will prevent circulation of a fluid in contact with a valve seat.

[0020] According to invention according to claim 4, if the piece of maintenance is moved, the piece of contact which is in an opposite side on both sides of an eccentric shaft will contact a press member, and, thereby, a press member will move to a valve rod.

[0021] according to invention according to claim 5 -- a press member -- the attaching part shell exterior -- turning -- a protrusion -- it is installation \*\*\*\*\* in the state the bottom, and it can be made to be able to expose to the case shell exterior of equipment, and means for switching can be attached, in case a fluid control unit is attached

[0022] According to invention according to claim 6, the installation number of a valve can be reduced by attaching the control-of-flow equipment equipped with the function

which controls the flow of a fluid directly, and the function in which circulation of a fluid can be compulsorily forbidden manually by means for switching, in one between a processing liquid supply means and a flow regulation means.

[0023] While according to invention according to claim 7 a control valve can be controlled by driving means and the fluid of a process line can be controlled by them by this, circulation of the fluid in a process line can be forbidden by forbidding operation of driving means by means for switching.

[0024] A process line can be stopped, if it is the control valve of the no MARIKU rose formula which is usually sometimes stopped according to invention according to claim 8 and operation of driving means will be forbidden by means for switching.

[0025] According to invention according to claim 9, since the drive fluid of subpiping is controllable by the opening-and-closing valve, this can be used as means for switching.

[0026] According to invention according to claim 10, the installation number of the valve to a process line can be reduced by attaching control-of-flow equipment equipped with the function which controls the flow of the fluid of a process line directly, and the function in which circulation of a fluid can be forbidden by means for switching, between a processing liquid supply means and a flow regulation means.

[0027] In addition, air, inert gas, oil, etc. are mentioned as a drive fluid.

[0028]

[Embodiments of the Invention] Hereafter, one example of this invention is explained with reference to a drawing.

<1st example> drawing 1 or drawing 3 starts one example of this invention, drawing 1 is the block diagram showing the outline composition of the substrate processor using the fluid control unit concerning this example, drawing 2 is drawing showing the circulation state of processing liquid, and drawing 3 is drawing showing the state where operated the shift lever and processing liquid was intercepted. In addition, the same sign is attached about the same composition as the conventional example mentioned above.

[0029] Processing liquid is stored by the processing tub 1, Substrate W is held into this, and processing is performed. To this processing tub 1, processing liquid is supplied through a process line 3. Free passage connection of the processing liquid source of supply 5 is made at the end side of a process line 3, and free passage connection of two or more branch pipes 7 is made at the other end side (only two are illustrated all over drawing). The flow control valve 9 which adjusts the flow rate of processing liquid is attached in each of two or more branch pipes 7. The flow control valve 9 is equipped with opening-and-closing valve 9a and throttle valve 9b, and throttle valve 9b is adjusted so that it may become a flow rate required for processing beforehand. A flow control valve 9 operates by the solenoid valve 11 which controls supply of the air from an air source of supply according to the control signal shown by the dotted-line arrow all over drawing.

[0030] In addition, the above-mentioned processing liquid source of supply 5 is equivalent to the processing liquid supply means in this invention, and the above-mentioned flow control valve 9 is equivalent to a flow regulation means.

[0031] The main-movement valve 21 which is the feature of this example is attached in the process line 3. This main-movement valve 21 has the function which controls circulation of the processing liquid in a process line 3, and operates by the solenoid valve 23 which controls supply of the air (drive fluid) from an air source of supply according to a control signal. The control signal to a solenoid valve 11 and a solenoid valve 23 is

given by the control section 25 which carries out generalization control of this substrate processor.

[0032] The main-movement valve 21 is equipped with the valve box 29 with which the passage 27 which has the entrance and outlet of processing liquid was formed. The valve seat 31 is formed near the center section of passage 27. This valve seat 31 is formed so that it may be mostly in agreement with the appearance of the valve element 33 which controls directly the flow of the processing liquid which contacts or estranges into the portion and circulates passage 27. The end of a valve rod 35 is connected with the valve element 33. Moreover, the valve box 29 is equipped with the attaching part 37 which holds a valve rod 35 possible [ the attitude to a valve seat 31 side ]. While the cylinder 38 is formed in this attaching part 37, the other end of a valve rod 35 is equipped with the piston 39 by which interlocking connection was carried out free [ sliding ] here. By the normal state, the piston 39 is energized by the compression spring 41 so that a valve element 33 may contact to a valve seat 31.

[0033] Moreover, the attaching part 37 equips with the 1st breakthrough 41 and 2nd breakthrough 43 the position whose piston 39 is pinched. While, as for the 1st breakthrough 41, supply of an air source of supply to air is controlled by the solenoid valve 23, the 2nd breakthrough 43 is wide opened by the atmosphere. If a solenoid valve 23 is operated, in a cylinder 38, a piston 39 will be moved to the 2nd breakthrough 43 side by air \*\*, and a valve element 33 will estrange from a valve seat 31 by it (refer to drawing 2 (a)). If operation of one of these and a solenoid valve 23 is stopped, a piston 39 will return in the energization direction and a valve element 33 will contact a valve seat 31 (refer to drawing 2 (b)).

[0034] The installation section 45 is arranged by the opposite side of a valve box 29 among attaching parts 37. the hole which is open for free passage in a cylinder 38 forms in this installation section 45 -- having -- \*\*\*\* -- here -- press -- the member 47 is inserted the press formed in the shape of a pin -- a member 47 is not illustrated -- it pulls, and in the piston 39, it is energized by the coil spring at the opposite side, and the end face section 47a is spherically formed of it

[0035] press -- the lever 48 of operation is arranged at the end face section 47a side of a member 47 This lever 48 of operation equipped the end side with the piece 51 of maintenance on both sides of the eccentric shaft 49, and is equipped with the piece 53 of contact which contacts an other end side at end face section 47a. Moreover, this main-movement valve 21 is attached to the wall material 55 outside the substrate processor in the portion of the installation section 45, and the lever 48 of operation is in the state where it projected to the outside wall material 55 shell exterior.

[0036] it is shown in drawing 3 -- as -- the piece 51 of maintenance of the lever 48 of operation -- a near side -- lengthening ( drawing 3 the direction of the upper left) -- the piece 53 of contact -- the circumference of an eccentric shaft 49 -- rotating -- press -- a member 47 is extruded towards a piston 39 and a valve element 33 contacts a valve seat 31 That is, the lever 48 of operation can switch the state of making a valve element 33 contacting compulsorily to a valve seat 31, and the state where a valve element 33 can estrange to a valve seat 31.

[0037] in addition, the press mentioned above -- a member 47 and the lever 48 of operation are equivalent to the means for switching in this invention, and the lever 48 of operation mentioned above is equivalent to attitude driving means



[0038] thus, the press arranged by the valve box 29 while controlling the flow of the processing liquid of a process line 3 by driving a valve element 33 by the attaching part 37 with which the valve box 29 was equipped -- circulation of a fluid is compulsorily forbidden irrespective of the operating state of an attaching part 37 by the member 47 and the lever 48 of operation. Since two functions, the conventional toggle bulb (13) and a relief valve (17), can be made into one by this, the main-movement valve 21 which can make an installation space small is realizable.

[0039] moreover -- if the piece 51 of maintenance of the lever 48 of operation is moved by hand -- press -- a member 47 moves to a valve rod 35, and can prevent circulation of a fluid. The circulation state of processing liquid can be known only by this looking at the state of the piece 51 of maintenance. Furthermore, the time of attaching -- press -- a member 47 -- the outer wall of a substrate processor -- since it can be made to be able to expose outside and can attach from a member 55, the circulation state of processing liquid is easily controllable by the lever 48 of operation from the outside of equipment.

[0040] thus, the function which controls the flow of processing liquid directly and press -- the installation number of a valve can be reduced by attaching the main-movement valve 21 equipped with the function in which circulation of processing liquid can be compulsorily forbidden manually by the member 47, in one between the processing liquid source of supply 5 and a flow control valve 9. Therefore, the installation space of the main-movement valve 21 in a substrate processor can be made small.

[0041] In addition, this invention is not limited to the above-mentioned operation gestalt, and deformation implementation is possible for it as follows.

[0042] (1) Driving means may be replaced with the valve element 33 which moves with air as mentioned above, and the valve element 33 which moves by electromagnetic may be used for them.

[0043] (2) the shift lever 48 equipped with the eccentric shaft 49 which attitude driving means mentioned above -- replacing with -- press -- you may adopt structure like a push button which is pushed in towards the attitude direction of a member 47.

[0044] (3) It is not necessary to necessarily attach a fluid control unit in the wall material 55 outside a substrate processor, it is attached in the interior of a substrate processor, and you may make it use it.

[0045] <2nd example> drawing 4 starts one example of this invention, and drawing 4 is the block diagram showing the outline composition of the substrate processor using the fluid control unit concerning this example. In addition, about detailed explanation, it omits by attaching a same sign about the same composition as the 1st example mentioned above.

[0046] The relief valve 17 (equivalent to the control valve of this invention) of the air drive formula for controlling the flow of processing liquid directly is arranged in the process line 3. This relief valve 17 serves as a no MARIKU rose formula, and the air as a drive fluid is supplied through the subpiping 61. Usually, although the air which circulates the subpiping 61 is controlled by the solenoid valve 23 (it is equivalent to the driving means of this invention), with this example equipment, the opening-and-closing valve 63 (equivalent to the means for switching of this invention) of a manual operation formula is further attached in the subpiping 61. In addition, a relief valve 17, the opening-and-closing valve 63, and the subpiping 61 constitute the main-movement valve 65, and this is equivalent to a fluid control unit.

[0047] The opening-and-closing valve 63 of the main-movement valve 65 switches the state of permitting the opening-and-closing drive of the relief valve 17 by the solenoid valve 23, and the state of forbidding the switching action of the relief valve 17 by the solenoid valve 23. Moreover, since the relief valve 17 of the main-movement valve 65 is a no MARIKU rose formula usually stopped sometimes, if operation of a solenoid valve 23 is forbidden with the opening-and-closing valve 63, a process line 3 can be stopped and control can be simplified. Moreover, although the opening-and-closing valve 63 (equivalent to the conventional toggle bulb 13) which needed to be attached in the process line 3 will be conventionally formed in the subpiping 61, since the path is very small as compared with a process line 3, installation of management of piping, a valve, etc. is also easy for the subpiping 61.

[0048] Thus, according to this example, the relief valve 17 of the main-movement valve 65 can be controlled by the solenoid valve 23 arranged by the subpiping 61, and circulation of the processing liquid in a process line 3 can be forbidden by forbidding operation of a solenoid valve 23 by the opening-and-closing valve 63 of the main-movement valve 65. Therefore, the number of the valve attached in a process line 3 can be reduced, and the fluid control unit which can make an installation space small can be realized. Moreover, composition can be simplified by using the opening-and-closing valve 63 as means for switching.

[0049] Moreover, the installation number of the valve to a process line 3 can be reduced by attaching control-of-flow equipment equipped with the function which controls the flow of the processing liquid of a process line 3 directly, and the function in which circulation of processing liquid can be compulsorily forbidden by the opening-and-closing valve 63, between the processing liquid source of supply 5 and a flow control valve 9. Therefore, the installation space of the fluid control unit in a substrate processor can be made small.

[0050] In addition, this 2nd example can carry out deformation implementation, as shown in the block diagram of drawing 5.

[0051] That is, the main-movement valve 67 is equipped with the relief valve 17 arranged by the process line 3 and the pushbutton switch 69 which closes / opens the control signal line given to a solenoid valve 23 from a control section 25. In this composition, the state where the control signal line is closed by the pushbutton switch 69 equivalent to means for switching, and the state where the control signal line is opened are equivalent to the state of permitting the opening-and-closing drive of the relief valve 17 by the solenoid valve 23, and the state of forbidding the switching action of the relief valve 17 by the solenoid valve 23, and a pushbutton switch 69 is equivalent to the means for switching in this invention.

[0052] Even if it is such composition, the same effect as the 2nd example mentioned above can be acquired. Since a pushbutton switch 69 is moreover only added, there is also an advantage that only an electric wiring change etc. is required.

[0053] In addition, the drive fluid in this invention is not limited to the air (air) mentioned above, and gases, such as inert gas (for example, nitrogen gas), and liquids, such as oil, may be used.

[0054] Moreover, the fluid control unit of this invention can be used also in other industries which deal with not only the substrate processor related technology in a semiconductor etc. but a fluid as explained in each example. Furthermore, it can use not

only for liquids, such as processing liquid, but for controlling a gaseous flow.  
[0055] Furthermore, the substrate processor of this invention is applicable even if it is the equipment which forms an application coat not only in the equipment which performs washing processing with the processing liquid mentioned above but in a substrate, equipment which performs plating processing.

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## DESCRIPTION OF DRAWINGS

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### [Brief Description of the Drawings]

[Drawing 1] It is the block diagram showing the outline composition of the substrate processor using the fluid control unit concerning the 1st example.

[Drawing 2] (a) is drawing showing the state where processing liquid circulates, and (b) is drawing showing the state where processing liquid was intercepted.

[Drawing 3] It is drawing showing the state where operated the shift lever and processing liquid was intercepted.

[Drawing 4] It is the block diagram showing the outline composition of the substrate processor using the fluid control unit concerning the 2nd example.

[Drawing 5] It is the block diagram showing the outline composition of the substrate processor using the fluid control unit concerning a modification.

[Drawing 6] It is the block diagram showing the outline composition of the substrate processor concerning the conventional example.

### [Description of Notations]

W -- Substrate

1 -- Processing Tub

3 -- Process Line

5 -- Processing Liquid Source of Supply (Processing Liquid Supply Means)

7 -- Branch Pipe

9 -- Flow Control Valve (Flow Regulation Means)

21 -- Main-Movement Valve (Fluid Control Unit)

37 -- Attaching Part (Driving Means)

47 -- Press Member (Means for Switching)

48 -- Lever of Operation (Means for Switching, Attitude Driving Means)

51 -- Piece of Maintenance

63 -- Opening-and-Closing Valve (Means for Switching)

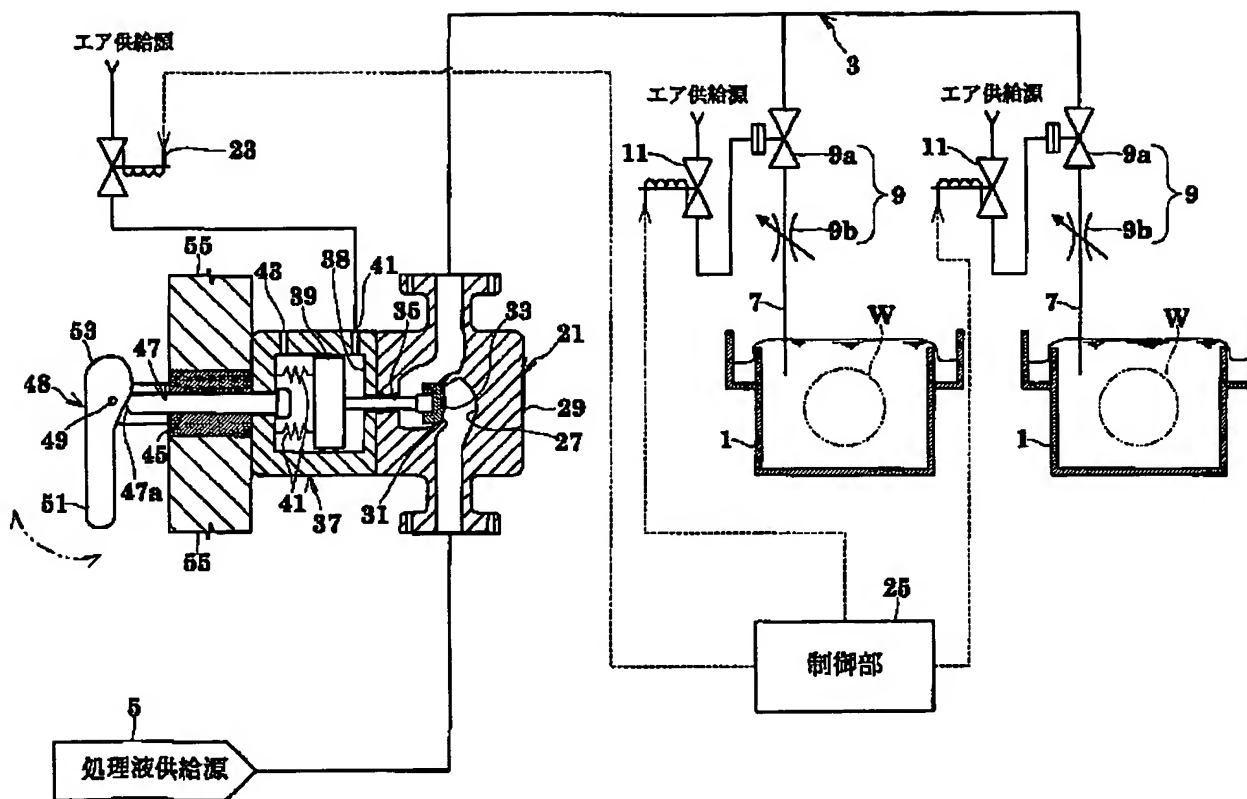
65 -- Main-Movement Valve (Fluid Control Unit)

67 -- Main-Movement Valve (Fluid Control Unit)

69 -- Pushbutton Switch (Means for Switching)

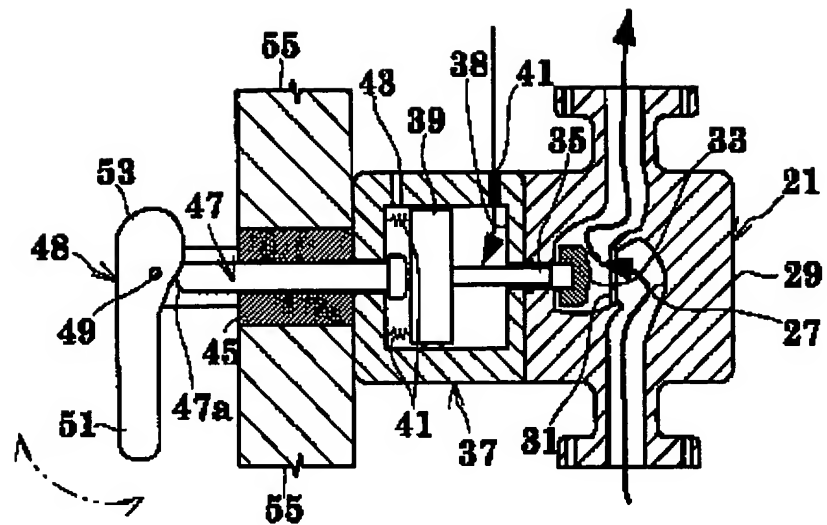
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[Drawing 1]

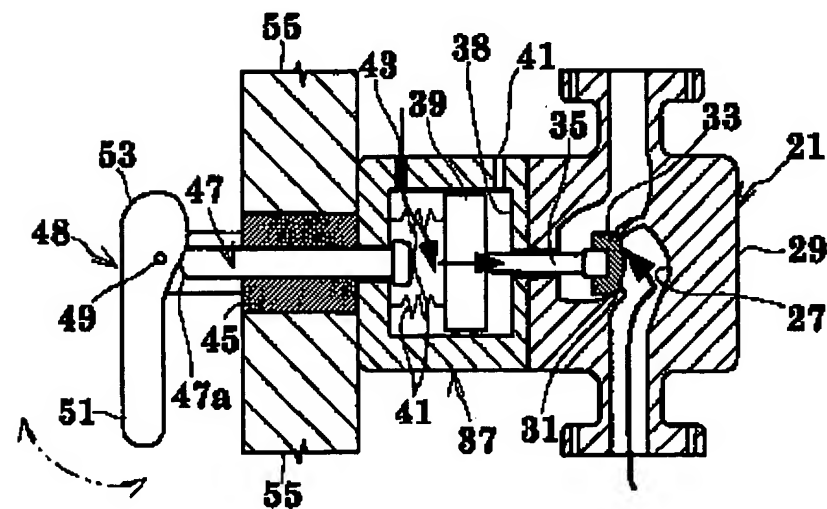


[Drawing 2]

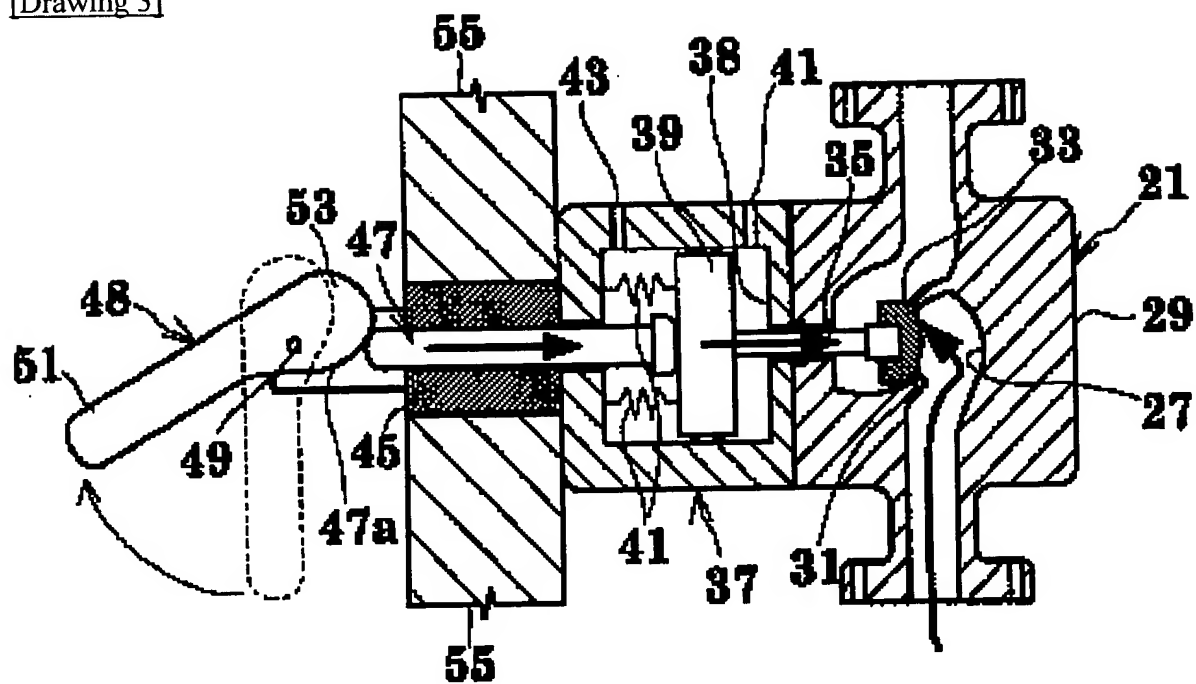
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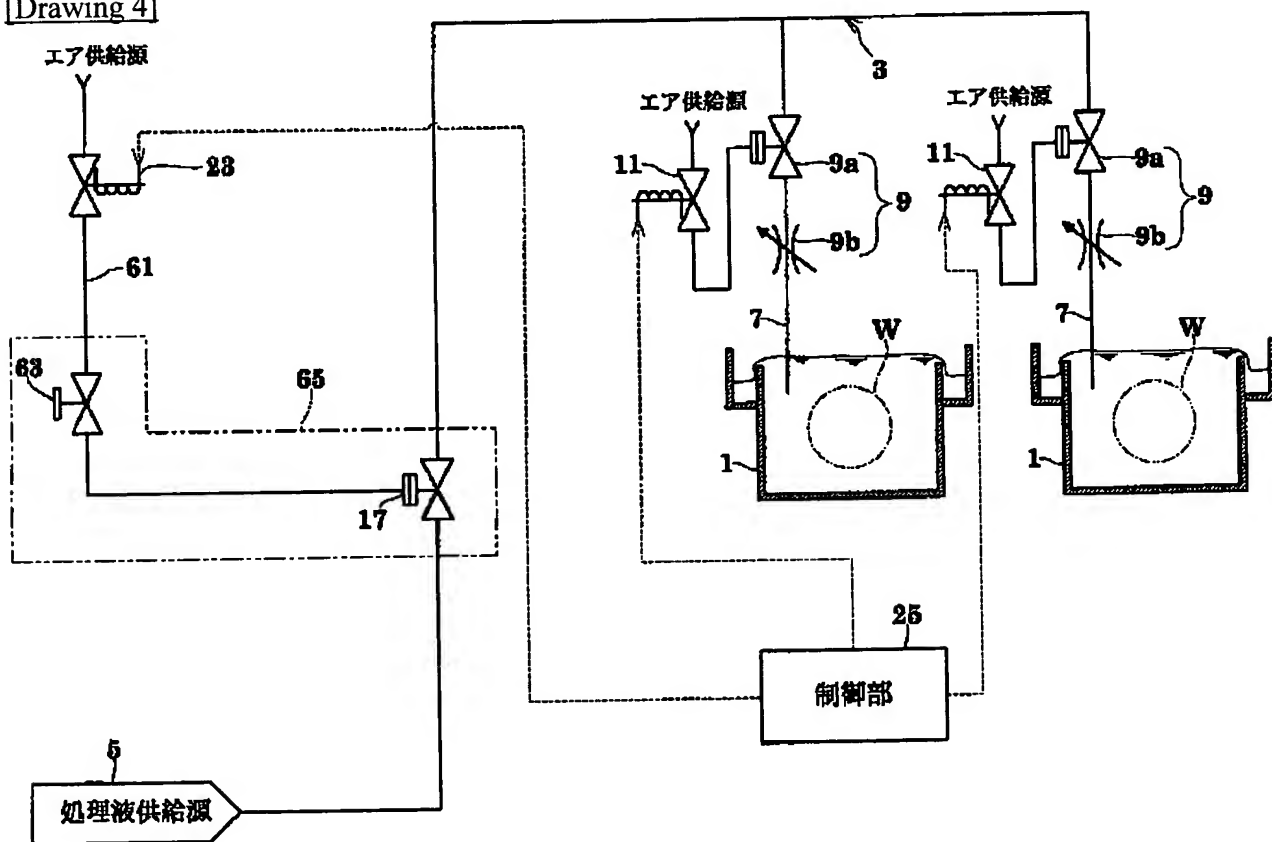
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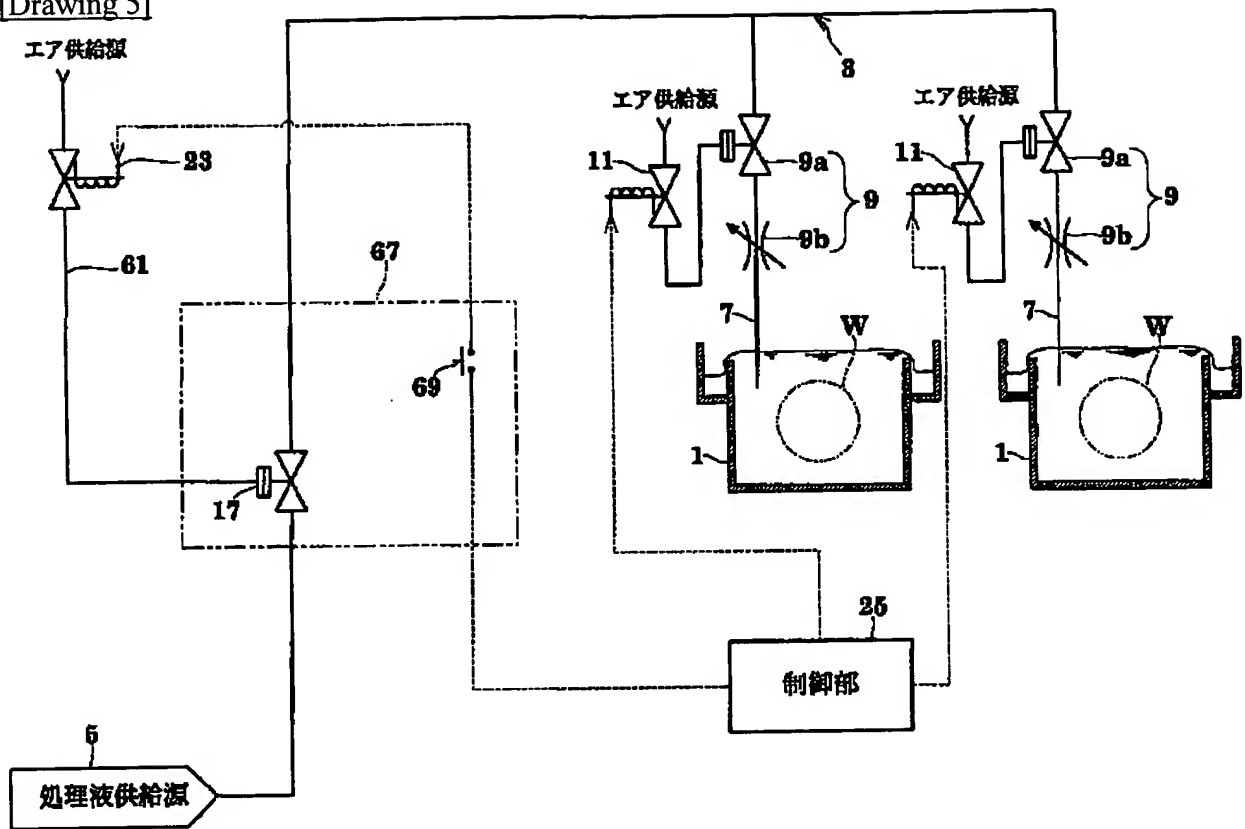
[Drawing 3]



[Drawing 4]



[Drawing 5]



[Drawing 6]

